WHAT IS CLAIMED IS:

1. An optical spectrometer, comprising:

an input port;

an optical detector;

at least a first transmissive diffraction grating disposed to diffract light received from the input port to the optical detector, light from the input port being diffracted parallel to a diffraction plane, the first transmissive diffraction grating being oriented so that light reflected by the first transmissive diffraction grating is reflected in a direction non-parallel to the diffraction plane; and

a first focusing unit disposed between the first transmissive diffraction grating and the optical detector, the first focusing unit focusing light from the first transmissive diffraction grating to the optical detector.

2. A spectrometer as recited in claim 1, wherein the input port includes a slit.

3. A spectrometer as recited in claim 1, wherein the input port includes an optical fiber.

4. A spectrometer as recited in claim 1, wherein an angle between a direction of reflection and the diffraction plane is greater than 1°.

5. A spectrometer as recited in claim 1, wherein the first focusing unit comprises at least one aspherical surface for focusing the light..

6. A spectrometer as recited in claim 1, further comprising a collimating unit between the input port and the first transmissive diffraction grating.

7. A spectrometer as recited in claim 6, wherein the collimating unit comprises an achromatic lens system.

8. A spectrometer as recited in claim 6, wherein the collimating unit comprises at least one aspheric optical surface.

9. A spectrometer as recited in claim 6, wherein the collimating unit is positioned at a distance from the input port such that light passing from the collimating unit to the first transmissive diffraction grating is collimated.

10. A spectrometer as recited in claim 1, wherein the optical detector comprises an array of detector elements.

11. A spectrometer as recited in claim 1, wherein the optical detector has a detector width, and an angle between a direction of reflection and the diffraction plane is selected so that the light reflected from the transmissive diffraction grating that is also reflected back through the transmissive diffraction grating reaches a focal plane of the first focusing unit separated from signal light at the detector by at least one half of the detector width.

12. A spectrometer as recited in claim 1, wherein the first transmissive diffraction grating is attached to a grating frame by a mounting, the mounting of the transmissive diffraction grating permitting independent expansion and contraction of the transmissive diffraction grating and the frame under conditions of changing temperature.

13. A spectrometer as recited in claim 12, wherein the mounting comprises a portion of adhesive located at a selected position along the grating frame.

14. A spectrometer as recited in claim 12, wherein the mounting comprises at least one or more clips holding the first transmissive diffraction grating to the frame.

15. A spectrometer as recited in claim 12, wherein the mounting comprises an elastic adhesive positioned along the frame between the frame and the first transmissive diffraction grating.

16. A spectrometer as recited in claim 1, further comprising an analyzer coupled to the detector to analyze detection signals produced by the detector.

17. A spectrometer as recited in claim 1, further comprising at least a second transmissive diffraction grating positioned on an optical path between the input port and the optical detector.

18. An optical spectrometer, comprising:

an input port;

an optical detector defining an active aperture;

at least a first transmissive diffraction grating disposed to diffract light received from the input port to the optical detector; and

a first focusing unit disposed between the first transmissive diffraction grating and the optical detector, the first focusing unit focusing light from the first transmissive diffraction grating to the optical detector;

wherein the first transmissive diffraction grating is oriented so that light, reflected from the transmissive diffraction grating and reflected back through the transmissive diffraction grating, reaches a focal plane of the first focusing unit outside the active aperture.

19. A method of aligning a spectrometer having at least a first transmissive diffraction grating, comprising;

passing light from an input port to the first transmissive diffraction grating;

diffracting the light in a diffraction plane by the first transmissive diffraction grating;

focusing the light diffracted by the first transmissive diffraction grating to a detector defining an active aperture; and

orienting the first transmissive diffraction grating so that light reflected by the first transmissive diffraction grating is reflected out of the diffraction plane.

20. A method as recited in claim 19, further comprising collimating the light passing from the input port to the first transmissive diffraction grating.

21. A method as recited in claim 19, further comprising selecting an angle between the light reflected by the first transmissive diffraction grating and the diffraction plane so that the light, reflected by the first transmissive diffraction grating and reflected back through the first transmissive diffraction grating, is focused to a position outside the active aperture.

22. A method as recited in claim 19, further comprising analyzing detection signals produced by the detector.

23. A method as recited in claim 22, further comprising displaying the analyzed signals.

24. A spectrometer, comprising;

an input port;

an optical detector;

at least a first diffraction grating unit disposed to diffract light received from the input port to the optical detector, light from the input port being diffracted parallel to a diffraction plane, the first diffraction

grating unit comprising a diffraction grating attached to a frame using a mounting, the mounting permitting independent thermal expansion and contraction of the grating and the frame under conditions of changing temperature; and

a first focusing unit disposed between the optical detector and the first diffraction grating unit, the first focusing unit focusing diffracted light from the first diffraction grating unit to the optical detector.

25. A spectrometer as recited in claim 24, wherein the mounting comprises a portion of adhesive at a position along the grating frame.

26. A spectrometer as recited in claim 25, wherein the portion of adhesive is disposed at one end of the grating frame.

27. A spectrometer as recited in claim 25, wherein the portion of adhesive is disposed in a notch on the frame so as to permit a lower surface of the diffraction grating to mate with an upper surface of the grating frame.

28. A spectrometer as recited in claim 25, further comprising one or more clips holding the transmissive diffraction grating to the grating frame.

29. A spectrometer as recited in claim 24, wherein the mounting comprises one or more clips holding the diffraction grating to the grating frame.

30. A spectrometer as recited in claim 24, wherein the mounting comprises a layer of elastic adhesive disposed between the grating and the grating frame.

31. A spectrometer as recited in claim 24, wherein the diffraction grating is disposed at an angle to reflect light in a direction nonparallel to the plane of the diffraction.

32. A spectrometer as recited in claim 24, wherein the diffraction grating comprises a transmissive diffraction grating.

33. A spectrometer as recited in claim 24, wherein the diffraction grating comprises a reflective diffraction grating.

34. A spectrometer as recited in claim 24, further comprising a first collimating unit between the input port and the first diffraction grating unit.

35. A spectrometer as recited in claim 34, wherein the first collimating unit comprises an achromatic lens system.

36. A spectrometer as recited in claim 34, wherein the first collimating unit is positioned at a distance from the input port such that light from the input port is collimated by the first collimating unit.

37. A spectrometer as recited in claim 24, wherein the optical detector comprises an array of detector elements.

38. A spectrometer as recited in claim 24, wherein the optical detector defines an active aperture, and the first transmissive diffraction grating is oriented so that a direction of reflection off the first transmissive diffraction grating is such that light reflected by the first transmissive diffraction grating and reflected back through the first transmissive diffraction grating reaches the focal plane of the first focusing unit outside the active aperture of the optical detector.

39. A spectrometer as recited in claim 24, further comprising an analyzer coupled to the detector to analyze detection signals produced by the detector.

40. A spectrometer as recited in claim 24, further comprising at least a second transmissive diffraction grating unit disposed on an optical path between the input port and the optical detector.

41. A method of mounting a diffraction grating to a frame, comprising;

attaching the diffraction grating to the frame while permitting independent thermal expansion and contraction of the diffraction grating and the frame under conditions of changing temperature.

42. A method as recited in claim 41, wherein attaching the diffraction grating to the frame comprises attaching the diffraction grating to the frame using a portion of adhesive at a position along the grating frame.

43. A method as recited in claim 42, further comprising placing the portion of adhesive at one end of the grating frame.

44. A method as recited in claim 42, further comprising placing the portion of adhesive in a notch on the grating frame so as to permit a lower surface of the diffraction grating to mate with an upper surface of the grating frame.

45. A method as recited in claim 41, wherein attaching the diffraction grating to the frame comprises clipping the diffraction grating to the grating frame using one or more clips.

46. A method as recited in claim 41, wherein attaching the diffraction grating to the frame comprises attaching the diffraction grating to the frame using an elastic adhesive.

47. A method as recited in claim 41, wherein the diffraction grating is a transmissive diffraction grating.

48. A method as recited in claim 41, wherein the diffraction grating is a reflective diffraction grating.

49. A spectrometer, comprising;

an input port;

an optical detector;

at least a first transmissive diffraction grating unit disposed to diffract light received from the input port to the optical detector, the first transmissive diffraction grating unit comprising a transmissive diffraction grating attached to a frame using a mounting; and

a first focusing unit disposed between the optical detector and one or more transmissive diffraction grating units of the at least one transmissive diffraction grating unit, the first focusing unit focusing diffracted light to the optical detector;

wherein the at least one diffraction grating unit, the first focusing unit and the optical detector are arranged to operate at light wavelengths in excess of 100 nm, and the temperature dependent wavelength shift of diffracted light at the optical detector is no more than 0.01 nm/K.

50. A spectrometer as recited in claim 49, wherein the temperature dependent wavelength shift of diffracted light at the optical detector is no more than 0.005 nm/K.

51. A spectrometer as recited in claim 49, wherein the first transmissive diffraction grating is formed in fused silica.

52. A spectrometer as recited in claim 49, further comprising at least a second transmissive diffraction grating unit disposed on an optical path between the input port and the optical detector.